

What is claimed is:

1. A nuclear magnetic resonance (NMR) logging tool for conducting measurements of a down hole formation, comprising:

- 5           (a) a permanent magnet having longitudinal axis;  
             (b) a nonmagnetic metal drill collar surrounding the permanent magnet;  
             (c) an antenna mounted on the outside of said drill collar; and  
             (d) one or more soft-magnetic elements installed in proximate relationship with the  
10          antenna, said soft-magnetic elements shaping radio frequency (RF) fields generated by the  
antenna;  
             (e) a motion detector generating signals corresponding to motions of the NMR  
logging tool.

2. The NMR tool of claim 1 further comprising a down hole signal processor for  
15          processing NMR signals from said formation.

3. The NMR tool of claim 1 further comprising a drill bit for drilling a borehole in  
said down hole formation.

4. The NMR tool of claim 1 further comprising one or more pre-polarization  
magnets positioned proximate said permanent magnet along its longitudinal axis.

20          5. The NMR tool of claim 4 comprising two pre-polarization magnets each pre-  
polarization magnet positioned at an end of said permanent magnet.

6. The NMR tool of claim 1, wherein said permanent magnet comprises a plurality  
of magnet segments.

25          7. The NMR tool of claim 6, wherein said plurality of magnet segments is made of  
rare earth materials.

8. The NMR tool of claim 1 further comprising one or more auxiliary antennas to  
enable sampling of radio frequency (RF) flux from the antenna.

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